

## CLAIMS

What is claimed is:

1           1.     A method for determining a type of disc in an optical disc  
2     recording/reproducing device comprising a photodetector divided into at least two light  
3     receiving sections in a radial direction, comprising:  
4           generating a radial push-pull signal from a difference between light receiving signals  
5     from a disk and received by the at least two light receiving sections, wherein the disk  
6     comprises one of a first disk and a second disk;  
7           detecting an upper envelope signal and a lower envelope signal from the radial push-  
8     pull signal;  
9           detecting a phase difference between the upper envelope signal and the lower  
10    envelope signal; and  
11          distinguishing the first disk from the second disk according to a magnitude of the  
12    phase difference, wherein the second disk comprises a density higher than the first disk.

1           2. The method as recited in claim 1, wherein the distinguishing determines the first  
2     disk if the phase difference is greater than or equal to a reference phase difference.

1           3. The method as recited in claim 1, wherein the distinguishing determines the  
2     second disk if the phase difference is less than a reference phase difference.

1           4. The method as recited in claim 1, further comprising  
2     receiving the magnitude of the phase difference and the light receiving signals and  
3     outputting servo error signals;  
4     using the servo error signals to output a voltage to drive a spindle motor of the disk.

1           5. The method as recited in claim 1, further comprising  
2     generating a first track cross signal from an envelope of an RF SUM signal, wherein  
3     the RF SUM signal is obtained by adding the light receiving signals;  
4     generating a second track cross signal from an envelope of the radial push-pull  
5     signal; and  
6     selectively outputting one of the first track cross signal and the second track cross  
7     signal according to the distinguishing of the first disk from the second disk.

1           6. The method as recited in claim 1, further comprising  
2           comparing the upper envelope signal with a predetermined threshold prior to  
3           detecting the phase difference; and  
4           binarizing the upper envelope signal prior to detecting the phase difference.

1           7. The method as recited in claim 1, further comprising  
2           comparing the lower envelope signal with a predetermined threshold prior to  
3           detecting the phase difference; and  
4           binarizing the lower envelope signal prior to detecting the phase difference.

1           8. A method, comprising:  
2           detecting a phase difference between an upper envelope signal and a lower envelope  
3           signal from a radial push-pull signal, wherein the radial push-pull signal is a difference  
4           between at least two light receiving signals from a disk and received by at least two light  
5           receiving sections in a photodetector, wherein the disk comprises one of a first disk and a  
6           second disk; and  
7           distinguishing the first disk from the second disk according to a magnitude of the  
8           phase difference, wherein the second disk comprises a density higher than the first disk.

1           9. The method as recited in claim 8, wherein the distinguishing determines the first  
2           disk if the phase difference is greater than or equal to a reference phase difference.  
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4           10. The method as recited in claim 8, wherein the distinguishing determines the  
5           second disk if the phase difference is less than a reference phase difference.

1           11. The method as recited in claim 8, further comprising  
2           generating a first track cross signal from an envelope of an RF SUM signal, wherein  
3           the RF SUM signal is obtained by adding the light receiving signals;  
4           generating a second track cross signal from an envelope of the radial push-pull  
5           signal; and  
6           selectively outputting one of the first track cross signal and the second track cross  
7           signal according to the distinguishing of the first disk from the second disk.

1           12. A method, comprising:  
2           obtaining a magnitude of a phase difference between an upper envelope signal of a  
3 radial push-pull signal and a lower envelope signal of the radial push-pull signal and  
4 determining a type of disk therefrom.

1           13. The method as recited in claim 12, further comprising  
2 dividing a photodetector into at least two light receiving sections in a radial  
3 direction; and  
4 generating the radial push-pull signal from a difference between light receiving  
5 signals from a disk and received by the at least two light receiving sections, wherein the  
6 disk comprises one of a first disk and a second disk.

1           14. The method as recited in claim 13, further comprising  
2 receiving the magnitude of the phase difference and the light receiving signals and  
3 outputting servo error signals;  
4 using the servo error signals to output a voltage to drive a spindle motor of the disk.

1           15. The method as recited in claim 14, further comprising  
2 generating a first track cross signal from an envelope of an RF SUM signal, wherein  
3 the RF SUM signal is obtained by adding the light receiving signals;  
4 generating a second track cross signal from an envelope of the radial push-pull  
5 signal; and  
6 selectively outputting one of the first track cross signal and the second track cross  
7 signal according to the distinguishing of the first disk from the second disk.

1           16. A method generating a track cross signal in an optical disk  
2 recording/reproducing device comprising a photodetector divided into at least two light  
3 receiving sections in a radial direction, comprising:  
4 generating a first track cross signal from an envelope of an RF SUM signal, wherein  
5 the RF SUM signal is obtained by adding light receiving signals from the at least two light  
6 receiving sections;  
7 generating a second track cross signal from an envelope of a radial push-pull signal,  
8 wherein the radial push-pull signal is obtained from a difference between the light receiving

9 signals from a disk and received by the at least two light receiving sections and wherein the  
10 disk comprises a first disk and a second disk;  
11 distinguishing the first disk from the second disk and outputting a signal indicative  
12 thereof, wherein the second disk comprises a density higher than the first disk; and  
13 selectively outputting one of the first track cross signal and the second track cross  
14 signal according to the output signal from the distinguishing.

1 17. The method as recited in claim 16, wherein the distinguishing determines the  
2 first disk if the phase difference is greater than or equal to a reference phase difference.

1 18. The method as recited in claim 16, wherein the distinguishing determines the  
2 second disk if the phase difference is less than a reference phase difference.

1 19. The method of claim 16, wherein the distinguishing:  
2 detecting an upper envelope signal from the radial push-pull signal;  
3 detecting a lower envelope signal from the radial push-pull signal; and  
4 detecting a phase difference between the upper envelope signal and the lower  
5 envelope signal,  
6 wherein the distinguishing determines the first disk from the second disk according  
7 to a magnitude of the phase difference.

1 20. An apparatus determining a type of disc in an optical disc recording/reproducing  
2 device comprising a photodetector divided into at least two light receiving sections in a  
3 radial direction, comprising:

4 a radial subtractor generating a radial push-pull signal from a difference between  
5 light receiving signals from a disk and received by the at least two light receiving sections,  
6 wherein the disk comprises one of a first disk and a second disk;

7 an upper envelope detector detecting an upper envelope signal from the radial push-  
8 pull signal;

9 a lower envelope detector detecting a lower envelope signal from the radial push-  
10 pull signal;

11 a phase comparator detecting a phase difference between the upper envelope signal  
12 and the lower envelope signal; and

13 a type of disk determiner the first disk from the second disk according to a  
14 magnitude of the phase difference and outputting a signal indicative thereof, wherein the  
15 second disk comprises a density higher than the first disk.

1 21. The apparatus as recited in claim 20, wherein the radial push-pull signal is an  
2 RF signal.

1 22. The apparatus as recited in claim 20, wherein the type of disk determiner  
2 determines the first disk if the phase difference is greater than or equal to a reference phase  
3 difference.

1 23. The apparatus as recited in claim 20, wherein the type of disk determiner  
2 determines the second disk if the phase difference is less than a reference phase difference.

1 24. The apparatus as recited in claim 20, further comprising  
2 a servo error generator and servo controller receiving the magnitude of the phase  
3 difference and the light receiving signals and outputting servo error signals;  
4 a servo driver amplifier receiving the servo error signals to output a voltage to drive  
5 a spindle motor of the disk.

1 25. The apparatus as recited in claim 20, further comprising a first comparator  
2 comparing the upper envelope signal with a predetermined threshold and binarizing the  
3 upper envelope signal prior to detecting the phase difference.

1 26. The apparatus as recited in claim 20, further comprising a second comparator  
2 comparing the lower envelope signal with a predetermined threshold and binarizing the  
3 lower envelope signal prior to detecting the phase difference.

1 27. The apparatus as recited in claim 20, further comprising  
2 a first track cross signal generator generating a first track cross signal from an  
3 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light  
4 receiving signals;  
5 a second track cross signal generator generating a second track cross signal from an  
6 envelope of the radial push-pull signal; and

7 a switch selectively outputting one of the first track cross signal and the second track  
8 cross signal according to the output signal from the type of disk determiner.

1 28. An apparatus, comprising:

2 a phase comparator detecting a phase difference between an upper envelope signal  
3 and a lower envelope signal from a radial push-pull signal, wherein the radial push-pull  
4 signal is a difference between at least two light receiving signals from a disk and received  
5 by at least two light receiving sections in a photodetector, wherein the disk comprises one  
6 of a first disk and a second disk; and

7 a type of disk determiner distinguishing the first disk from the second disk  
8 according to a magnitude of the phase difference and outputting a signal indicative thereof,  
9 wherein the second disk comprises a density higher than the first disk.

1 29. The apparatus as recited in claim 28, wherein the type of disk determiner  
2 determines the first disk if the phase difference is greater than or equal to a reference phase  
3 difference.

1 30. The apparatus as recited in claim 28, wherein the type of disk determiner  
2 determines the second disk if the phase difference is less than a reference phase difference.

1 31. The apparatus as recited in claim 28, further comprising  
2 a first track cross signal generator generating a first track cross signal from an  
3 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light  
4 receiving signals;

5 a second track cross signal generator generating a second track cross signal from an  
6 envelope of the radial push-pull signal; and

7 a switch selectively outputting one of the first track cross signal and the second track  
8 cross signal according to the output signal from the type of disk determiner.

1 32. An apparatus, comprising:

2 a type of disk determiner obtaining a magnitude of a phase difference between an  
3 upper envelope signal of a radial push-pull signal and a lower envelope signal of the radial  
4 push-pull signal and determining therefrom the type of disk and outputting a signal  
5 indicative thereof.

1           33. The apparatus as recited in claim 32, further comprising  
2           a photodetector divided into at least two light receiving sections in a radial direction;  
3       and  
4           a radial push-pull signal generator generating the radial push-pull signal from a  
5       difference between light receiving signals generated by the at least two light receiving  
6       sections.

1           34. The apparatus as recited in claim 33, further comprising  
2           an upper envelope detector detecting the upper envelope signal from the radial push-  
3       pull signal; and  
4           a lower envelope detector detecting the lower envelope signal from the radial push-  
5       pull signal.

1           35. The apparatus as recited in claim 34, further comprising  
2           a servo error generator and servo controller receiving the magnitude of the phase  
3       difference and the light receiving signals and outputting servo error signals;  
4           a servo driver amplifier receiving the servo error signals to output a voltage to drive  
5       a spindle motor of the disk.

1           36. The apparatus as recited in claim 35, further comprising  
2           a first track cross signal generator generating a first track cross signal from an  
3       envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding the light  
4       receiving signals;  
5           a second track cross signal generator generating a second track cross signal from an  
6       envelope of the radial push-pull signal; and  
7           a switch selectively outputting one of the first track cross signal and the second track  
8       cross signal according to the output signal from the type of disk determiner.

1           37. The apparatus as recited in claim 32, wherein the type of disk is one of a first  
2       disk and a second disk, wherein the second disk comprises a higher density than the first  
3       disk.

1           38. An apparatus generating a track cross signal in an optical disk  
2 recording/reproducing device and comprising a photodetector divided into at least two light  
3 receiving sections in a radial direction, comprising:

4           a first track cross signal generator generating a first track cross signal from an  
5 envelope of an RF SUM signal, wherein the RF SUM signal is obtained by adding light  
6 receiving signals from the at least two light receiving sections;

7           a second track cross signal generator generating a second track cross signal from an  
8 envelope of a radial push-pull signal, wherein the radial push-pull signal is obtained from a  
9 difference between the light receiving signals from a disk and received by the at least two  
10 light receiving sections and wherein the disk comprises a first disk and a second disk;

11          a type of disk determiner distinguishing the first disk from the second disk and  
12 outputting a signal indicative thereof, wherein the second disk comprises a density higher  
13 than the first disk; and

14          a switch selectively outputting one of the first track cross signal and the second track  
15 cross signal according to the output signal from the type of disk determiner.

1           39. The apparatus of claim 38, wherein the type of disk determiner distinguishes the  
2 first disk from the second disk according to a magnitude of a phase difference between an  
3 upper envelope signal of the radial push-pull signal and a lower envelope signal of the  
4 radial push-pull signal.

1           40. The apparatus of claim 38, wherein the type of disk determiner comprises:  
2 an upper envelope detector detecting an upper envelope signal from the radial push-  
3 pull signal;

4           a lower envelope detector detecting a lower envelope signal from the radial push-  
5 pull signal; and

6           a phase comparator detecting a phase difference between the upper envelope signal  
7 and the lower envelope signal,

8           wherein the type of disk determiner distinguishes the first disk from the second disk  
9 according to a magnitude of the phase difference.